



LaRC LESSONS LEARNED WORKSHOP

***25 Years of JPL Experience Refining
a Mature Lessons Learned Process***

David Oberhettinger

Office of the Chief Engineer

Jet Propulsion Laboratory, California Institute of
Technology

August 23, 2011



What Does Mature Process Look Like?

Office of the Chief Engineer

- Process attributes
 - Lessons important to the institution are identified, ranked
 - Lessons are credible: range of technical viewpoints are reflected
 - Lessons are readable: format, quality writing, photos
 - Lessons are verified as accurate to avoid “blowback
 - Important lessons are documented and approved
 - Lessons are disseminated internally; projects assess compliance
 - Lessons are shared with NASA?
 - Lessons are *infused* to ensure a closed-loop process
 - Process also engages the institutional Corrective Action System
 - Process is well documented
 - Process maturity undergoes continuous improvement
- Prerequisites
 - Organizational commitment to lessons learning
 - Culture of openness: ability to admit and discuss mistakes



Lessons Learned Process History

Office of the Chief Engineer

- **1978:** Spaceflight Significant Event File published by Walter K. Victor
 - SSEF maintained as 3-ring binder; SSEF last published in 1987
 - **1979:** SSEF suspended
 - **1984:** SSEF reactivated by Dr. Allen, JPL Director
- **1984:** JPL Lessons Learned Committee (LLC) chartered
 - **Oct 1984:** LLC meetings chaired by Kermit Watkins, Flight Project Office
- **1985-1994:** Developed several JPL on-line systems
 - GPVAX, ITIMS, and EDMS; Lessons Learned Channel terminated 1999
- **1992:** NASA Lessons Learned Steering Group formed
 - NASA Centers started contributing lessons learned in 1992
- **1994:** Rollout of NASA on-line database
 - Combined Automated Lessons Learned (CALL) maintained by GSFC
 - **1996:** Current LLIS developed
- **2010:** *Infusion* cross-references vetted by JPL Engineering Board



Generating Lessons Learned

Office of the Chief Engineer

- Formal JPL lessons learned requirements = currently fairly minimal
- Impact of Lessons Learned Committee on lessons learned process
 - Quality and quantity → credibility
 - How attained:
 - Strong representation by technical divisions, SMA organization, Chief Engineer
 - Independence from programs/projects
 - Intensive working meetings (LCC meetings/follow-up is not inexpensive.)
 - Validation of lesson learned candidates, and verification of facts
 - Transition to “single author” model
 - Documentation: candidate list, LLC minutes, PFR-to-LL matrix, infusion matrix
 - Need 0.5–1.0 FTE to manage and support the lessons learned process
- **Collection.** Target-rich environment: need to prioritize candidates
- **Writing.** Lesson learned must be a “good read” as well as accurate
 - Presently, attaining this requires familiarity with HTML code



Examples

Office of the Chief Engineer

- *Shaker Self-Check Unexpectedly Exceeded the Dynamic Test Limit:* Shakers automatically perform a nominal self check, but Juno found that it exceeded the test level!
- *Beware of Smocks With Metal Sleeve Fasteners:* Metal snap fastener on the sleeve of a tester's lab coat (ESD smock) shorted a PCB
- *Electrical Outage Revealed Emergency Systems Not Functioning:* How do you know the exit signs will work during a power outage?
- *Do Not Reuse Anti-Static Bags:* A reused envelope contained conductive debris that shorted out flight hardware.
- *Lessons Learned on the WISE Launch Campaign from the PLAR:* This resulted from a request for the project to conduct a LL briefing.
- *Dawn Ion Propulsion System Lessons Learned:* Dawn inherited the 6 year old IPS design from DS1: may need to re-qualify the contractor as well as re-qualifying the design



Lessons Learned “Infusion”

Office of the Chief Engineer

- **Solution to non-use:** achieve closed-loop lessons learned process by infusing lessons into engineering procedures and training
 - No longer dependent on project self-audits (or the initiative of individuals)
 - The JPL Chief Engineer proposed a 6-month exercise
- Attempted to infuse lessons into technical standards of the JPL groups
 - **Problem:** lesson recommendations not consistent with requirements docs
 - **Problem:** tracked group completion using Corrective Action Notices
 - **Problem:** excess complexity. Made little progress.
- **Revised approach:** infuse into specific paragraphs in the JPL *Design Principles* and *Flight Project Practices*
 - Requirements at appropriate level, where relevance to lessons is clear
 - Each project is audited for compliance, subject to waiver
 - Documents controlled by a single organization (OCE)
 - For credibility, cross-references vetted by JPL Engineering Board (JEB)



Engage Corrective Action System

Office of the Chief Engineer

- PRACA system provides a source of lessons learned
 - “*Lesson Learned?*” checkbox on Problem/Failure Report (PFR) form
 - PFRs reviewed by LLC Chair, then by LLC, with results documented
- Oh by the way, JPL lacks a Corrective Action Board (CAB)
 - No mechanism to resolve failures with JPL-wide implications
 - JPL generates ~200 PFRs per month
 - Establishment of formal JPL CAB not likely
- Lessons Learned Committee also serves as ad hoc CAB
 - The checkbox screens issues that may have impacts beyond the project
 - LLC evaluates checked PFRs as candidates for (1) lessons learned, (2) Corrective Action Notices (CANs), and/or (3) NASA Alerts
 - This leverages the technical scope of LLC representation
 - CAN recommendation is forwarded to the JPL office that issues CANs
- Future improvements to the CAB process?



Continuous Improvement

Office of the Chief Engineer

- *Kaizen* approach: systematically → small, incremental, improvements
- Update *Evidence of Recurrence Control Effectiveness* field in LLIS
 - Infusion provides objective evidence of closed-loop process
 - Some effort required to maintain infusion process
- Dissemination
 - Do we adequately communicate information on this resource JPL-wide?
 - 1996 Lessons Learned Information Day, 1996 & 1997 Common Threads Workshops, booth at 2000 Safety Day
 - Planning for a “Nieberding” workshop at JPL
- Pressure projects to perform lessons learned outbriefings
 - I’ve begun to contact PMs prior to major project milestones
- NASA is cross-referencing lessons learned with technical standards
- Are LLIS improvements needed? Are there useful process metrics?
- What else would improve the lessons learned process?